

ZARVA, A.V.

Studying pebbly beaches on the Caucasian coast of the Black Sea in  
the Tuapse-Adler section. Trudy Okean.kom. 4:13-17 '59.  
(MIRA 13:4)

1. Chernomorskaya gidrologicheskaya stantsiya Vsesoyuznogo nauchno-  
issledovatel'skogo instituta transportnogo stroitel'stva Mintrans-  
stroya.

(Black Sea--Beaches)

TSVELIKH, Petr Timofeyevich [TSvelykh, P.T.]; ZARVA, L., red.; TSURKAN, P.,  
tekhn. red.

[The development of production relations during the transition of  
communism] Rozvytok sotsialistychnykh vyrobnychyykh vidnosyn v period  
perekhodu do komunizmu. Kyiv, Derzh.vyd-vo polit.lit-ry URSR, 1960.  
126 p. (MIRA 14:12)

(Russia--Economic conditions) (Russia--Economic policy)

ZARVA, V.

Aeronautics without airports. Kryn. rod. 8 no.2:20-22 F '57.  
(Airplanes) (MLRA 10:4)

ZARVA, V., EIRSTYN', V., RUTKOVSKIY, YU.

Radio - Interference

The struggle against interference. Radio, 29, No. 3, 1952.

Monthly List of Russian Accessions, Library of Congress, June 1952. Unclassified.

ZARYA, Y.A.; GINZBURG, Z.B.; LARIONOV, G.Ye., tekhnicheskiy redaktor.

[Magnetic phenomena] Magnitnye yavleniya. Moskva, Gos.energ. izd-vo  
1951, 111 p. (Massovaya radiobiblioteka, no.119) [Microfilm]  
(Electromagnetism) (Ferromagnetism) (MIRA 8:4)

ZARVA, V. A.

Science

Magnetic phenomena, Moskva, Gosenergoizdat, 1951.

Monthly List of Russian Accessions, Library of Congress, December 1952. Unclassified.

1. ZARVA, V.A.
2. USSR (600)
4. Science
7. Magnetic phenomena. Moskva, Gosenergoizdat, 1952

9. Monthly List of Russian Accessions, Library of Congress. February, 1953. Unclassified.

ZARVIN, Ye. Ye., MIKHAYLETS, H. S., and DEMYKIN, K. V.

"The Smelting of Rail Steel from Low-Manganese Pig Iron  
Without the Addition of Ferromanganese in the Boiling Period"

Stal' No. 5, 1956, pp 431-437.  
Siberian Metallurgical Inst.  
Kuznetsk Metallurgical Kombinat

Translation M-3,053,011, 19 Dec 56

COMMON ELEMENTS										PROCESSES AND PROPERTIES INDEX										1ST AND 2ND COLUMNS									
ZARVIN, E. Y.																				9									
ca																													
<p>The influence of the casting temperature on the properties of killed carbon steel. E. Ya. Zarvin and F. N. Agaletskii. <i>Tekhn. Prikl. Met.</i> 10, No. 11, 27-31 (1938); <i>Chem. Zvest.</i> 1939, 11, 511. —The defects in ingots cast in the Kirov works from a steel contg. 0.6-0.7% C were due to unsatisfactory casting conditions. Increasing the temp. from 1415 to 1470° for the casting of heavy ingots weighing 7 metric tons reduced cavity formation, segregation, etc., without increasing crack formation and other flaws. The casting rate should be about 0.8-0.9 metric tons per min.; the total duration of the casting process, however, should be as short as possible. M. G. Moore</p>																													
<p>150-514 METALLURGICAL LITERATURE CLASSIFICATION</p>																													
<p>IRON STEEL</p>										<p>STEEL</p>										<p>IRON</p>									
<p>STEEL</p>										<p>STEEL</p>										<p>IRON</p>									

MCHIEDLISHVILI, Vakhtang Aleksandrovich; LYUBIMOVA, Galina Aleksandrovna;  
SAMARIN, Aleksandr Mikhaylovich; ZARVIN, Ye.Ye., red.; ROZEN-  
TSVEYG, Ya.D., red.izd-vn; EVENSON, I.M., tekhn.red.

[Role of manganese in preventing the harmful effect of sulfur  
on the quality of steel] Rol' margantsa v ustraneni vrednogo  
vliianiia sery na kachestvo stali. Moskva, Gos.nauchno-tekhn.  
izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1960. 53 p.  
(MIRA 13:5)

(Manganese)

(Steel--Metallurgy)

Zarvin, Ye. Ya.

SOV/137-58-8-16482

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 8, p 36 (USSR)

AUTHORS: Zarvin, Ye. Ya., Zil'bershteyn, M. B.

TITLE: On the Rate of Absorption of Hydrogen From Furnace Gases  
(O skorosti pogloshcheniya vodoroda iz pechnykh gazov)

PERIODICAL: Tr. Sibirsk. metallurg. in-ta, 1957, Nr 4, pp 58-68

ABSTRACT: Gases evolving from molten metal in furnaces of 185- and 370-t capacity were withdrawn by means of a steel bell with no internal lining and with the following dimensions: diameter 220 mm; height 250 mm; wall thickness 6 mm. The gases were stored in a gas-collector unit. The operation of withdrawal of gases required 1-1.5 minutes. The composition of gases collected varied within the following limits: 83.0-97.0% CO, 1.4-8.0% CO<sub>2</sub>, 0.6-6.0% H<sub>2</sub>, 0-0.6% CH<sub>4</sub>, and 0.3-4.0% N<sub>2</sub>. The presence of CH<sub>4</sub> indicated that secondary reactions were taking place in the bell and in the flue pipe. According to computations, the intensity of the absorption of H<sub>2</sub> from the flue gases amounted to 0.34 and 0.20 cm<sup>3</sup>/100 g·min in the 185-t and the 370-t furnace, respectively, at the beginning of the pure-boiling stage and, analogously, 0.51 and 0.40 cm<sup>3</sup>/100 g·min at the end of that period.

Card 1/1

A.S.

1. Furnaces--Properties 2. Hydrogen--Absorption 3. Waste gases  
--Chemical analysis

ZARVIN, Ye. Ye., kand. tekhn. nauk; DEMYKIN, K.V., inzh.; VASIL'YEV, A.M.,  
inzh.

Sulfur balance in 370-ton and 190-ton converter smelting of low-  
manganese and ordinary pig iron. Izv. vys. ucheb. zav.; chern.  
met. no.4:23-35 Ap '58. (MIRA 11:6)

1. Sibirskiy metallurgicheskiy institut i Kuznetskiy metallurgi-  
cheskiy kombinat.

(Bessemer process) (Sulfur)

POLUKHIN, Petr Ivanovich, prof., doktor tekhn. nauk; GRDINA, Yu.V.,  
prof., ~~doktor tekhn.~~ nauk; ZARVIN, Yevgeniy Yakovlevich, prof.;  
GROMOV, N.P., prof., nauchnyy red.; GOROBINCHENKO, V.M., inzh.,  
red. izd-va; ATTOPOVICH, M.K. [deceased], tekhn. red.

[Rolling and heat treatment of railroad rails] Prokatka i termi-  
cheskaia obrabotka zheleznodorozhnykh rel'sov. [By] P.I. Polukhin  
i dr. Moskva, Metallurgizdat, 1962. 510 p. (MIRA 16:2)  
(Rolling (Metalwork)) (Railroads--Rails)

ZARVIN, YE. YA.

137-1958-1-335

Translation from: Referativnyy zhurnal, Metallurgiya, 1958, Nr 1, p 51 (USSR)

AUTHORS: Zarvin, Ye. Ya., Zil'bershteyn, M.B.

TITLE: Rate of Absorption by Metal of Hydrogen From Furnace Gases  
(K voprosu o skorosti pogloshcheniya metallom vodoroda iz  
pechnykh gazov)

PERIODICAL: V sb.: Fiz.-khim. osnovy proiz-va stali. Moscow, AN SSSR.  
1957, pp 553-559. Diskus. pp 650-655

ABSTRACT: A study of the rate of absorption by metal of H from furnace gases during melts in basic open hearth furnaces of 185 and 370 ton capacity was made on the basis of data on the H content of the metal and slag, and the results of determinations of the composition and quantity of the gases liberated from the bath. A general view of an installation for removing gas from the metal bath during a heat is adduced. Metal specimens were sampled during the period of boil by immersing steel beakers into the molten bath. Slag samples were taken in a flow viscosimeter. The composition of the gases varied within the following percentual limits in the entire group of heats: CO 83-97, CO<sub>2</sub> 1.4-8, H<sub>2</sub> 0.6-6, CH<sub>4</sub> 0.0-0.6, N<sub>2</sub> 0.3-4.0. During the period of

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137-1958-1-335

# Rate of Absorption by Metal of Hydrogen From Furnace Gases

pure boil,  $[H]$  fluctuated in the 1.8 - 6.2 ml/100g range. The rate of absorption of  $H_2$  from the furnace gases was established on the basis of the equation:  $\Delta H + \Delta H' = \Delta H''$ , where  $\Delta H$  is the amount of H liberated from the bath with CO bubbles per minute;  $\Delta H'$  is the amount of  $H_2$  going to increase the amount thereof in the bath during the same period, or the amount of H liberated on reduction of the content thereof in the bath (in the latter case this quantity will be negative in sign);  $\Delta H''$  is the amount of  $H_2$  absorbed from the furnace gases per minute. This equation holds only for the period of pure boil. Depending on the absolute H content in the liquid bath and the composition and the viscosity of the slag, an increase in the rate at which the C burns off may either have no effect at all or a positive effect on  $[H]$ . At the end of the period of pure boil the rate of absorption by the metal of H from the furnace gases is greater than at the start of that period. The hypothesis is advanced that the greater rate of absorption of H at the end of pure boil is explainable by the considerable rise in temperature and basicity of the slag. Rise in temperature is accompanied by a drop in the  $(\Sigma H):[H]$  ratio, and an increase in the basicity of the slag is accompanied by an

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137-1958-1-335

Rate of Absorption by Metal of Hydrogen From Furnace Gases

increase in absorption of H thereby. The rate of absorption of H in a 370-ton furnace is lower than in a 185-tonner, and this confirms the possibility of smelting high-quality metal in large capacity furnaces. The Authors have come to the conclusion that the speed at which H is transported from furnace gases into the metal attains a high order of magnitude.

I.P.  
1. Liquid metals--Hydrogen absorption--Test results 2. Hydrogen  
--Absorption 3. Open hearth furnaces--Performance 4. Liquid  
metals--Sampling

Card 3/3

ZARVIN, Ye.Ya.; SHIROKOV, N.I.; GORDEYEVA, L.T.

Effect of the deoxidation method on nonmetallic inclusions  
and fatigue properties of rail steel. Izv. vys. ucheb. zav.;  
chern. met. 7 no.10:41-44 '64.

(MIRA 17:11)

1. Sibirskiy metallurgicheskiy institut.

KRAMAROV, A.D.; TOESTOGUZOV, N.V.; ZARVIN, Ye.Ye.; TIMMERMAN, V.P.; LEVIN, A.M.; GUROV, A.K.

Making manganese alloys from Usa deposit manganese ores. Izv. vys. ucheb. zav.; chern. met. no.12:46-54 '60. (MIRA 14:1)

1. Sibirskiy metallurgicheskii institut.  
(Usa Valley—Manganese ores)  
(Manganese alloys—Metallurgy)

ZARVIN, Ye.Ya.; KRAMAROV, A.D.; TOLSTOGUZOV, N.V.; GUROV, A.K.; LEVIN, A.M.;  
TIMMERMAN, V.P.

Use of silicomanganese made of Usa ores for the reduction of  
steel. Izv. vys. ucheb. zav.; chern. met. no.12:55-62 '60.  
(MIRA 14:1)

1. Sibirskiy metallurgicheskiy institut.  
(Usa Valley--Ore deposits)  
(Silicon-manganese alloys)

ZINOV'YEV, V.T.; ZARVIN, Ye.Ya.

Using a model to investigate splashing during the blowing of open-hearth furnaces by compressed air. Izv.vys.ucheb.zav.; Chern.Met. 8 no.8:41-43 '65. (MIRA 18:8)

1. Sibirskiy metallurgicheskiy institut.

ZARVIN, Ye. Ye. dotsent; MIKHAYLETS, N.S., inzhener; DEMYKIN, K.V.,  
inzhener.

Using low-manganese pig iron without adding ferromanganese during  
the boiling stage in the smelting of rail steel. Stal' 16 no.5;  
431-437 My '56. (MLRA 9:8)

1. Sibirskiy metallurgicheskiy institut i Kuznetskiy metallurgi-  
cheskiy kombinat.

(Smelting) (Ferromanganese)

ZARVIN, Ye. Ya.

1. The first part of the report is devoted to the study of the properties of the function  $f(x)$  defined on the interval  $[0, 1]$  and satisfying the conditions  $f(0) = 0$  and  $f(1) = 1$ .

2. The second part of the report is devoted to the study of the properties of the function  $f(x)$  defined on the interval  $[0, 1]$  and satisfying the conditions  $f(0) = 0$  and  $f(1) = 1$ .

YAVOYSKIY, V.I., otv. red.; BIGEYEV, A.M., red.; BORKO, Ye.A., red.; GLINKOV, M.A., red.; ZARVIN, Ye.Ya., red.; KAPUSTIN, Ye.A., red.; KOCHO, V.S., red.; KUDRIN, V.A., red.; LAPITSKIY, V.I., red.; LEVIN, S.L., red.; LKS, G.N., red.; ROMENETS, V.A., red.; UMRIKHIN, P.V., red.; FILIPPOV, S.I., red.

[Theory and practice of the intensification of processes in converters and open-hearth furnaces; transactions]  
Teoriia i praktika intensifikatsii protsessov v konferte-  
rakh i martenovskikh pechakh; trudy. Moskva, Metallurgiya,  
1965. 552p. (MIRA 18:10)

1. Mezhvuzovskoye nauchnoye soveshchaniye po teorii i  
praktike intensifikatsii protsessov v konverterakh i mar-  
tenovskikh pechakh. 2. Moskovskiy institut stali i splavov  
(for Filippov). 3. Zhdanovskiy metallurgicheskii institut  
(for Kapustin). 4. Ural'skiy politekhnicheskii institut  
(for Umrikhin).

ZARYA, A.N., inzh.

Operating conditions of hydraulic coal dredging equipment and  
its protection during automation. Trudy VNIIGidrouglia no.3:  
147-153 '63 (MIRA 18:2)

1. Donetskii politekhnicheskii institut.

BORUMENSKIY, A.G., dots.; ZARYA, A.N., inzh.

Apparatus for the automatic control of coal suction plants in  
hydraulic mines. Ugol' Ukr. 3 no.11:38-40 N '59.

(MIRA 13:3)

1. Donetsk'iy industrial'nyy institut,  
(Hydraulic mining) (Automatic control)

ZARYA, K.I., okulist; FILIPPENKO, N.M., zootekhnik

Prevention of invalidity in collective farmers suffering  
from eye diseases. Fel'd. i akush. 28 no.4:27-28 Ap'63.

(MIRA 16:8)

1. Kolkhoz "Put' Lenina", Faleshtskiy rayon, Moldavskaya SSR  
(for Filippenko).

\*

ZARYA. K.I.; KOZIN, A.V.

Organization of measures decreasing the incidence of eye diseases in village polyclinics. Zdravookhraneniye 6 no.1: 20-23 J-F'63. (MIRA 16:8)

1. Iz Faleshtskoy rayonnoy bol'nitsy (glavnyy vrach A.V. Kozin).

(MOLDAVIA—PUBLIC HEALTH, RURAL)  
(MOLDAVIA—EYE—DISEASES AND DEFECTS)

ZARYA, V. S.

21 Jul 53

USSR/Nuclear Physics - Cosmic Ray Components

"Study of Monionizing Components of Cosmic Rays in the Stratosphere," V. S. Zarya,  
Yu. A. Smorodin, Z. I. Tulinova, Phys Inst im Lebedev, Acad Sci USSR, Moscow State U  
DAN SSSR, Vol 91, No 3, pp 495-498

Previous works (see Vernov et al. DAN SSSR, 61, 4; 62,3; 73,3 (1948-1950) proved  
electron nature of soft component in stratosphere. Such electrons should be followed  
by photons, the intensity of which may be computed using cascade theory. Expts per-  
formed in 1949 with balloons confirmed that no less than half of secondary cosmic  
particles are generated in stratosphere by photons. Presented by Acad D. V.  
Skobel'tsyn 29 May 53.

262T69

ZARYADOVA, Ye. A.

USSR / Human and Animal Physiology. Digestion, Stomach.

T

Abs Jour : Ref Zhur - Biol., No 15, 1958, No. 70252

Author : Zaryadova, Ye. A.; Gorolik, Ye. M.

Inst : Grodnensk Agricultural Institute

Title : Studies of the Secretory and Motor Functions of the Stomach

Orig Pub : Tr. Grodnensk. s.-kh. in-ta, 1957, No 3, 273-276

Abstract : The addition of concentrates of vitamins A (12,500-15,000 units per 100 kg) and D (1000 units per 100 kg) to the food of shoats early in the spring led to an increase in weight and secretion of the gastric succus, and also increased its digestive powers and acidity. The movements of the stomach became more frequent and uniform; there was an acceleration of evacuation of the gastric contents.

Card 1/1

ZAR'YAN, Nairi; SEREBRYAKOV, K. [translator]

[There the cherry blossomed; Japanese sketches. Translated  
from the Armenian] Tam tsvela vishnia; iaponskie ocherki.  
Moskva, Sovetskii pisatel', 1965. 183 p. (MIRA 18:10)

ZAR'YAN, R.N.

Characteristics of the distribution of some rare elements in the  
ores of the Kafan deposit. Izv. AN Arm. SSR. Nauki o zem. 17 no.  
3/4:71-78 '64. (MIRA 17:11)

1. Institut geologicheskikh nauk AN Armyanskoy SSR.

ZAR'YAN, R.N.

Mineralogy of ores of the Atkizskiy section in the Kadzharan deposit.  
Zap.Arm.otd.Vses.min.ob-va no.2:22-26 '63. (MIRA 16:10)

ZAR'YAN, R.N.

Mineralization stages of the Kafan copper-complex metal deposit.

Izv. AN Arm.SSR, Geol.i geog.nauki 16 no.4/5:131-142 '63.

(MIRA 16:12)

1. Institut geologicheskikh nauk AN Armyanskoy SSR.

ZAR'YAN, R.N.

Occurrence forms of selenium and tellurium in ores of the Kafan deposit. *GeoKhimiia* no.3:236-242 '62. (MIRA 15:4)

1. Institute of Geological Sciences, Academy of Sciences Armenian Socialist Republic.  
(Kafan District--Selenium) (Kafan District--Tellurium)

P'ARMAZYAN, A.S.; ZAR'YAN, R.N.

Characteristics of the geochemistry of selenium and tellurium in  
ores of the Kadzharan ore zone. Geokhimiia no.11:1164-1170 N '62.  
(MIRA 18:8)

1. Institute of Geological Sciences, Academy of Sciences of the  
Armenian S.S.R., Erivan.

ZAR'YAN, R.N.

Tellurides and lead tellurites in the Kafan ore deposit.  
Izv. AN Arm. SSR. Geol.i geog. nauki 15 no.2:25-30 '62.

(MIRA 15:5)

1. Institut geologicheskikh nauk AN Armyanskoy SSR.  
(Kafan District--Tellurides) (Kafan District--Tellurites)

*ZARYANKIN, A. Ye.*

AID P - 2870

Subject : USSR/Engineering

Card 1/1 Pub. 26 - 3/16

Authors : Deych, M.Ye., Kand. Tech. Sci., and Zaryankin, A.Ye.,  
Eng.

Title : Research and improvement of nozzle plates of the control  
stage

Periodical : Teploenergetika, 10, 14-20, 0 1955

Abstract : Some results of research on nozzle plates, made in  
order to compare the operation of the two main types  
(the narrowing and the widening profile) are discussed.  
The research method, the characteristic of the nozzle  
plates, and the results achieved are explained in  
detail. Twelve diagrams. One Russian reference, 1954,  
1 German, 1910.

Institution : Moscow Power Institute

Submitted : No date

ZARYANKIN, A. Ye.:

ZARYANKIN, A. Ye.: "Investigation of the boundary layer in turbine gratings at high speeds." Min Higher Education USSR. Moscow Order of Lenin Power Engineering Inst imeni V. M. Molotov. Moscow, 1956.  
(Dissertation for the Degree of Candidate in Technical Sciences).

SO: Knizhaya letovis', No 23, 1956

ZARYANKIN, A. Ye.

124-57-2-2000 D

Translation from Referativnyy zhurnal, Mekhanika, 1957, Nr 2, p 74 (USSR)

AUTHOR: Zaryankin, A. Ye.

TITLE: Investigation of the Boundary Layer in Turbine Cascades at High  
Speeds (Issledovaniye pogranichnogo sloya v turbinnykh  
reshetkakh pri bol'shikh skorostyakh)

ABSTRACT: Bibliographic entry on the author's dissertation for the degree of  
Candidate of Technical Sciences, presented to the Mosk. energ.  
in-t (Moscow Power Institute), Moscow, 1956.

ASSOCIATION: Mosk. energ. in-t (Moscow Power Institute), Moscow

1. Turbines--Performance 2. Boundry layer--Analysis

Card 1/1

ZARYANKIN, A. E.

96-3-8/26

AUTHOR: Deych, M.E. (Dr. Tech.Sci.) & Zaryankin, A.E. (Cand.Tech.Sci.)

TITLE: An experimental investigations of the turbulent boundary layer at high subsonic speeds. (Eksperimental'noye issledovaniye turbulentogo pogranichnogo sloya pri bol'shikh dozvukovykh skorostyakh.)

PERIODICAL: Teploenergetika, 1958, No.3. pp. 21-25 (USSR)

ABSTRACT: In order to investigate the turbulent boundary layer at high subsonic speeds the Moscow Power Institute set up the rig illustrated diagrammatically in Fig.1. The boundary layer investigated was set up on the straightground section of the upper insert 1. To ensure that the boundary layer was turbulent a shallow groove was cut. A micro-nozzle was fitted 120 mm from the groove. The micro-nozzle was positioned by means of a micrometer screw. The installation could be used to determine the characteristics of the boundary layer during independent change in the M and Re numbers and the pressure gradient. The magnitudes determined by direct measurement were the initial pressure, the pressure of complete retardation in the boundary layer, the temperature of complete retardation, the static pressure along the investigated surface and the static pressure across the boundary layer at the section where the nose of the micro-probe was. In almost all of the tests the change of the static pressure in the boundary layer was small. Several equations required in the work are formulated. Fig.2. gives six velocity profiles obtained at a constant Reynolds number of  $2.5 \times 10^6$  with the

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93-3-6/20

An experimental investigation of the turbulent boundary layer at high subsonic speeds.

number  $M$  variable. All the experimental points within the range  $M = 0.31 - 0.98$  lie on a single curve, an expression for which is given; without great error the curve can be replaced by a straight line, the formula for which is given. Other formulae are, of course, possible, and any relationship that satisfactorily approximates the velocity profile in the boundary layer of an incompressible liquid can be extended to a flow of compressible fluid. The extrapolation need not be limited to sonic speed but can be extended to low supersonic speeds, but in this case it is difficult to obtain pure gradientless flow. From the results it is also possible to calculate values of the integral thicknesses of the layer and to construct curves of them as a function of  $M$  as shown in Fig.3. The scatter of experimental points near sonic speeds occurs because of 'confuser' type flow. The scatter of points at subsonic speeds occurs because the points relate to different values of Reynolds number. The experimental results are in full accordance with theory. Experimental values for the height of the boundary layer for different values of  $M$  are given in Fig.4. On nearing the sonic speed the reduction in thickness of loss of impulse is about 15%. Since the velocity profile is independent of  $M$  it may be supposed that  $Re$  is the main parameter that determines the velocity profile

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96-3-6/26

An experimental investigation of the turbulent boundary layer at high subsonic speeds.

in the absence of a pressure gradient, and the results of numerous experiments on its influence in an incompressible fluid can be extrapolated to a flow in a compressible fluid. Fig.5. gives six velocity profiles obtained whilst varying  $Re$  whilst keeping  $M$  constant. Increase in  $Re$  from  $0.61 - 1.08 \times 10^6$  causes a characteristic change in the velocity profile, but further increase in  $Re$  does not cause a change in the velocity profile. Therefore, for values of  $Re$  greater than about  $1 \times 10^6$  the velocity profiles are expressed by the general relationship Eq(8). At high speeds the influence of  $Re$  on the turbulent boundary layer is qualitatively of the same order as in flows of incompressible fluid. To investigate the influence of  $M$  in the presence of a pressure gradient, velocity profiles were determined in the diffuser region (Fig.6A) and during 'confuser' flow Fig. 6B. The curves show that all the experimental points fall on a single curve, whatever the value of  $M$ . This confirms the conclusion that at subsonic speeds change in  $M$  does not cause appreciable change in the velocity profile. The influence of compressibility on the structure of the turbulent boundary layer is indirect. Change in the longitudinal pressure gradient, from a positive to a negative value, leads to considerable deformation of the velocity profiles and is clearly seen from the curves in Fig.7. From the curve given in Fig.8. it follows that when the velocity distribution at the outer edge of the boundary layer is

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96-3-0/20

An experimental investigation of the turbulent boundary layer at high subsonic speeds.

approximately linear calculations by the single parameter method are justified. A more general conclusion cannot be drawn in the absence of experimental data relating to other values of the second differential coefficient. There are 8 figures and 3 literature references (Russian).

ASSOCIATION: Moscow Power Institute (Moskovskiy Energeticheskiy Institut ).

AVAILABLE: Library of Congress.

Card 4/4

DEYCH, M.Ye.; ZARYANKIN, A.Ye.; SHERSTYUK, A.N.; DINYEV, Yu.N.

Investigation of gate mechanisms of radial-flow turbines.  
Nauch.dokl.vys.shkoly; energ. no.4:195-206 '58.

(MIRA 12:5)

1. Rekomendovana kafedroy parovykh i gazovykh turbin Moskovskogo  
energeticheskogo instituta.  
(Gas turbines)

SOV/96-58-9-10/21

AUTHORS: Deych, M.Ye. (Doctor of Technical Science) and  
Zaryankin, A.Ye. (Candidate of Technical Science)

TITLE: An Approximate Method of Calculating Terminal Losses in  
Turbine Blading (Priblizhennyy metod rascheta kontsevykh  
poter')

PERIODICAL: Teploenergetika, 1958, Nr 9, pp 57 - 60 (USSR)

ABSTRACT: A great deal of experimental data has been accumulated on the structure of flow in straight gratings of turbine blades and on the magnitude of terminal losses. The experimental results show that in a straight grating of turbine blades there is a complex spatial flow of working substance which cannot yet be calculated adequately. Existing methods of evaluating terminal losses depend on a number of simplifying assumptions. It is, therefore, of interest to attempt to derive a formula for these losses. Formula 16 is then derived: one of its factors is a function of the dimensionless velocity, and can be obtained from the curve given in Fig 1. Numerical values of the other two factors in the formula can be determined from Fig 2, which gives a graph

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SOV/96-58-9-10/21

An Approximate Method of Calculating Terminal Losses in Turbine Blading

of experimental data for terminal losses obtained for impulse and reaction blading with different values of pitch, height and inlet and outlet angles. It is concluded that the coefficients depend on the flow conditions in the boundary layer and on the type of blading. Allowing that the results given in Fig 2 were made in different laboratories with different experimental procedures, the scatter of the results is acceptable. Values of the coefficients to be used in the formula that have been derived from the test results are tabulated.

There are 2 figures, 1 table, 4 literature references (Soviet)

ASSOCIATION: Moskovskiy energeticheskiy Institut (Moscow Power Institute)

1. Turbine blades--Performance
2. Mathematics--Applications

Card 2/2

MEYCH, M.Ye., doktor tekhn. nauk; ZARYANKIN, A.Ye., kand. tekhn. nauk

Approximate method for the calculation of the turbulent boundary layer  
at high speed. Trudy MEI no,30:218-231 '58. (MIRA 12:5)

1. Moskovskiy ordena Lenina energeticheskiy institut, Kafedra parovykh  
i gazovykh turbin.

(Boundary layer)

DEYCH, Mikhail Yefimovich; SAMOYLOVICH, Georgiy Semenovich; BIKNEV, V.S.,  
kand.tekhn.nauk, retnenzent; SHERSTYUK, A.N., kand.tekhn.nauk,  
dotsent, red.; ZARYANKIN, A.Ye., kand.tekhn.nauk, red.; MODEL',  
B.I., tekhn.red.

[Fundamentals in aerodynamics of axial-flow turbomachines]  
Osnovy aerodinamiki osevykh turbomashin. Moskva, Gos.nauchno-  
tekhn.izd-vo mashinostroit.lit-ry, 1959. 427 p. (MIRA 12:8)  
(Turbomachines--Aerodynamics)

SOV/96-60-2-3/24

AUTHORS: Deych, M. Ye., Doctor of Technical Sciences, Zaryankin, A. Ye., Candidate of Technical Sciences, Filippov, G.A., and Zatsepin, M. F., Engineers

TITLE: Methods of Increasing the Efficiency of Turbine Stages with Short Blades

PERIODICAL: Teploenergetika, 1960, Nr 2, pp 18-24 (USSR)

ABSTRACT: The efficiency of the high-pressure parts of large turbines having fixed and runner blades of improved profiles and provided with good internal glands and seals reaches 78 to 80%. Further improvements in profiling are not likely to give much better efficiency, as modern blades already have very low profile-losses. However, the efficiency of intermediate high-pressure stages can be appreciably increased by special profiling of the fixed blades in the meridional plane and by using runner blades with diffuser channels. Meridional profiling is now being developed to give stages of constant reaction. In high-pressure stages this problem is best solved by trying to reduce the end losses. In order to reduce the end losses in fixed blades, it is necessary to reduce the velocity on sections of maximum

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SOV/96-60-2-3/24

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channel curvature where secondary flows are most marked. This ensures turbulent flow and so reduces the thickness of boundary layers on the backs of the blading and on the upper and lower walls of the channel. This is accomplished by profiling the channels along their height (profiling in the meridional plane). The profiling may be symmetrical with straight or curved faces, or asymmetrical with straight or curved generating lines. Asymmetrical profiling makes it possible both to reduce the end losses and to reduce the radial pressure gradient. The present article gives test results on blading with asymmetrical profiling over the height, both with the blades mounted in straight rows and on rotors. Fig 1 gives graphs of the loss distribution over the height of a straight row of blades with different shapes of the upper rim. It will be seen that the best results are obtained with asymmetrical profiling beyond the position where the curvature of the channel is greatest. The reduction in fixed-blade losses by the use of

Card 2/6 asymmetrical profiling is explained by reference to the

SOV/96-60-2-3/24

Methods of Increasing the Efficiency of Turbine Stages with Short Blades

graph of pressure distribution across the profile given in Fig 2. It is also pointed out that in the blading with asymmetrical profiling the point of minimum pressure is displaced somewhat in the direction of flow. Hence the length of the turbulent section and the pressure gradients in it are somewhat reduced. This has the effect of reducing the profile losses. The loss-coefficient curves plotted in Fig 3 clearly show the advantages of blades with asymmetrical profiling over the height, particularly for short blading. The effect of this special profiling is greater when the blades are mounted on a rotor because the losses at the blade roots are particularly reduced, thereby helping to equalise the velocity distribution. The best shape of profiling is then considered. Graphs of loss reduction as a function of profiling compression, plotted in Fig 4, indicate that the optimum amount of compression depends on the blade length. The shape of the compression curve may be based on calculation of the flow potential in the channel. A diagram of a profiled channel with three

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SOV/96-60-2-3/24

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different degrees of compression is given in Fig 5, and calculated and experimental velocity distributions over a straight arrangement of blading caps TS-2A is given in Fig 6. It will be seen that agreement between theory and experiment is good. Tests on intermediate-stage fixed blades with diffuser inlets showed that under static conditions their use does not influence the effect of asymmetrical profiling over the height. Test results are plotted in Fig 7 and it is considered that the use of fixed blades with a complicated shape of outer rim increases the efficiency of intermediate stages with short blades. Further information about the use of fixed blades with asymmetrical profiling was obtained by testing groups of stages in the experimental steam turbine of the Moscow Power Institute. All stages have the same mean diameter of 400 mm; the other dimensions are tabulated. Tests were made on six stages of various blade lengths. Some were made with fixed blades profiled over the height and some with unprofiled blades. All the diaphragms were welded.

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SOV/96-60-2-3/24

Methods of Increasing the Efficiency of Turbine Stages with Short Blades

The tests covered a fairly wide range of velocity ratio and heat drop. The results, plotted in Fig 8, indicate that at optimum velocity ratio the stage with profiled blades has 2% higher efficiency with a blade length of 25 mm, and 3% higher with a length of 15 mm. The relative increase in efficiency by the use of asymmetrical profiling is 2.5% and 3.7 to 4% respectively. Asymmetrically-profiled blades continue to offer advantages when operation is not at the designed conditions, as is explained by reference to other curves on Fig 8. Important results were obtained on measuring the reaction in the blade root and tip sections. The use of asymmetrical profiling reduces the variations in static pressure distribution over the pitch in the sections. As will be seen from the graphs plotted in Fig 9 there was also a marked reduction in the difference between the reactions at the root and tip. The value of the outlet area of the guide vanes may be calculated from formula (1). An approximate method is given for calculating the asymmetrical profiling, using

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Methods of Increasing the Efficiency of Turbine Stages with Short Blades

Eq (2). It is concluded that asymmetrical profiling of the fixed blades across the height helps to give stages with constant reaction over the radius. In stages with very short blading any profiling of the channels over the height undertaken to reduce the difference in reaction should also be designed to reduce the end losses. The method of asymmetrical profiling that is proposed in this article solves these two problems. There are 9 figures, 1 table and 4 Soviet references. ✓

ASSOCIATION: Moskovskiy energeticheskiy institut (Moscow  
Power Institute)

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S/024/60/000/02/010/031  
E194/E155

AUTHOR: Zaryankin, A.Ye. (Moscow)

TITLE: Terminal Losses in the Nozzle Equipment of Radial Turbines ✓

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1960, Nr 2, pp 67-72 (USSR)

ABSTRACT: The article opens with a general discussion of losses when fluid flows in turbine blading. It is shown that the terminal losses include friction losses on the walls, losses due to secondary flows and losses due to compensating movement at the ends of the blades. Any changes of conditions or geometry that have the effect of increasing the transverse pressure gradient in the duct, or of thickening the boundary layers, increase the terminal losses. Accordingly, a satisfactory numerical evaluation of terminal losses cannot be obtained by considering one-dimensional or even two-dimensional flow, whilst the difficulties of making calculations on complicated three-dimensional flow have not yet been overcome. In this article, the theory of dimensions and extensive experimental data are used to evaluate the end losses. In the general case, they may be represented by

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E194/E155

Terminal Losses in the Nozzle Equipment of Radial Turbines

the functional relationship of formula (1). This expression is considered from the standpoint of the theory of dimensions and is rewritten in dimensionless form in expression (2). Here the unknown function depends on two parameters that are geometrical and two that relate to conditions. Extensive experimental evidence indicates that terminal losses depend mainly on blade geometry and are usually little affected by conditions. Accordingly, expression (2) is resolved into a Taylor series and if angles are also replaced by trigonometrical functions expression (3) is obtained. The method of obtaining the coefficients of this series is then explained. In the first place, the expression (3) is rearranged in the form of a series of powers to give expression (4); the coefficients in this expression can still only be determined experimentally. If only the quadratic term of the series is considered the absolute value of the terminal losses is given by expression (5), which is developed in various ways to obtain formula (19) for the terminal losses in the

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Terminal Losses in the Nozzle Equipment of Radial Turbines

nozzle blading of a radial centripetal turbine. If it is assumed that flow in the boundary layer is turbulent, the end-loss formula may be simplified to the form of expression (20). As reliable data are not available for blading with a fully turbulent layer, it is difficult to assess the coefficient entering into this expression, and an approximate value is accordingly recommended. Analogous formulae are easily obtained for radial blading with flow from the centre. In this case, represented in Fig 3, the flow takes place with a positive pressure gradient so that the stability of the boundary layer is much lower and it is necessary in the calculations to use formulae for integral characteristics of a turbulent boundary layer. Expression (24) is then obtained for the terminal losses in this case. If it is assumed that the value of the coefficient  $B$  in Eqs (20) and (24) is the same, then these formulae may be used to assess the increase in terminal losses in radial blading with flow from the centre. In particular cases the losses can easily be double those with flow towards the

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Terminal Losses in the Nozzle Equipment of Radial Turbines

centre and the analysis clearly shows the advantage of nozzle equipment in radial turbines with flow towards the centre. From the structural formulae for terminal losses that are derived it may be concluded that the value of the terminal losses may be much reduced by taking steps to reduce the thickness of the boundary layers. Certain recommendations are made to this end. There are 3 figures and 3 Soviet references.

Card  
4/4

SUBMITTED: December 10, 1959

87892

S/114/60/000/005/006/006  
E194/E255

26.212.0

AUTHORS:

Deych, M. Ye., Doctor of Technical Sciences,  
Zaryenkin, A. Ye., Candidate of Technical Sciences,  
Lebedev, A. Ye., Candidate of Technical Sciences and  
Frolov, L. B., Engineer

TITLE:

An Instrument for Measuring the Torque, Speed and  
Power on High-Speed Turbines

PERIODICAL: Energomashinostroyeniye, 1960, No. 5, pp. 43-47

TEXT: In development work on blading very high speed  
experimental turbines are used, and the customary methods of  
measuring torque are often inapplicable. It is most convenient  
in such cases to measure torque in terms of the angular strain  
of the rotating shaft, but when the speed is of the order of  
35 000 r.p.m. it is very difficult to take current from moving  
contacts on the rotor. An investigation of the operation of the  
various pickups carried out in the Moscow Power Engineering  
Institute showed that satisfactory results may be obtained with  
induction pickups, which are easily fitted to both experimental  
and regular production turbines. Impulses from these pickups can  
be used to measure both torque and speed. Two toothed magnetic  
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S/114/60/000/005/006/006

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An Instrument for Measuring the Torque, Speed and Power on High-Speed Turbines

discs are fitted to the rotating shaft and as they turn they induce impulses in the pickups. When there is no strain and the shafts are not twisted, the pickups are arranged with a phase displacement of half the pitch of one of the teeth in the disc. As the machine is loaded and the shaft twists the phase relationship between the two series of impulses alters and is measured. The instrument has two shaping circuits, each containing an amplifier, a limiter, a differentiating circuit and an impulse generator. This shaper circuit serves to amplify the pickup signal and to convert it into a signal of standard shape with a steep wave-front. There is a comparator device that measures the phase relationship between the impulses. The same pickups are used for speed measurement. The output of the shaping circuits is applied to a trigger, which is a switching device controlling the charging and discharging of capacitors. The mean charging current of the capacitors is proportional to the speed. The reliability of the measurements depends on the construction of the

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# An Instrument for Measuring the Torque, Speed and Power on High-Speed Turbines

pickups. The pickup base is made of permalloy sheet 0.1 mm thick clamped between two diamagnetic holders; it carries a measuring coil of 100-500 turns. The output of the measuring coils has a saw-tooth wave-shape, the amplitude of which increases with the speed. A schematic circuit of the instrument is given and the various units, namely, the shaping unit, the torque measuring unit, the speed measuring unit and the power measuring unit are briefly described. An experimental rig for testing the device was set up. It consisted of a motor driving the shaft with toothed discs which in turn drove a generator, using special couplings. The arrangement was such that a calibration curve could be obtained of the instrument reading as a function of the pickup displacement, as plotted in Fig. 7. The graph shows a linear relationship between the instrument reading and the phase displacement. In measuring torque with an electronic dynamometer good results could be obtained by using torsion couplings, the design of which is briefly described. In preliminary tests the

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sensitivity was 100 microns displacement over the full scale, corresponding to a maximum angle of twist of  $0.1^\circ$ ; however, the readings were not stable and depended on the speed of the disc. When the sensitivity was reduced to  $0.5^\circ$  of twist for full scale the readings were stable and independent of speeds. Good results can also be obtained using photo-electric pickups with the shafts rotating at any speed, including low speeds. In some cases the toothed wheels may be replaced by magnetic inserts of various kinds: the load on the flexible couplings of a turbine type 8K-100 (VK-100) can be measured in this way. By using the instrument on power station turbines feeding into a common system it is possible to investigate transient processes in the machines when the system load changes, and to obtain satisfactory data about the operation of the governor system. There are 8 figures and 3 references; 1 Soviet and 2 non-Soviet.

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X

81811

26.1000  
10.3000

S/096/60/000/08/011/024  
E194/E484

AUTHORS: Deych, M.Ye., Doctor of Technical Sciences,  
Zaryankin, A.Ye., Candidate of Technical Sciences,  
Filippov, G.A. and Zatsepin, M.F., Engineers

TITLE: Increasing the Efficiency of Short Turbine Runner Blades<sup>2/0</sup>

PERIODICAL: Teploenergetika, 1960, Nr 8, pp 51-56 (USSR)

ABSTRACT: Work published in Teploenergetika, 1956, Nr 6, and by Nippert in Germany in 1929 has shown that if the angle through which a flow turns in a channel is great and the static pressures at inlet and outlet are not very different, the losses due to secondary flow in curved ducts and in short blades are not minimum when the flow is steadily constricted. Nippert showed that when the flow is turned through a large angle, the use of expansion followed by constriction of the ducts between the blades greatly reduces the terminal losses. The theoretical problem is very complicated and it is best to determine the optimum velocity distribution by experiments. Tests were made on the Moscow Power Institute blading for subsonic speeds details of which are given in Table 1. These profiles are intended for

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E194/E484

### Increasing the Efficiency of Short Turbine Runner Blades

short blades and were obtained by cutting back the concave surfaces in such a way that the channel between the blades first expands then contracts. The convex surface of the blade is left unaltered. Typical duct dimensions for blades shapes TR2A and TR-2Ak are shown in Fig 1. In the new blades the inlet section is greater than the outlet section and the maximum section at the middle of the blades is greater than the inlet section. With blades of this type, the variations in channel section are, of course, affected by the pitch and angle of installation of the blading. Tests were made with blades of various heights and various ratios of maximum inlet and discharge widths. The range of variation of the main geometrical characteristics for blades of group Ak are shown in Table 2. The tests were made in the wind tunnel of the Moscow Power Institute with nozzles ranging from 20 to 50 mm high. The advantages of an expanding and constricting channel for short blades was confirmed by experiment. Pressure diagrams for channels of

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Increasing the Efficiency of Short Turbine Runner Blades

different shapes with blade type TR-2A are shown in Fig 1. The results are discussed and it is concluded that there are three causes of the reduced terminal losses in blades with expanding and constricting channels, namely: the direction of the flow is altered at the lower mean speed; at the outlet section where secondary flows are intensified, the channel is constricted so that longitudinal pressure gradients are increased; in cross-section the length of the expanding section of the channel on the back of the blade is reduced as the point of minimum pressure is displaced in the direction of the flow. As will be seen from Fig 2, absolute values of loss factors in blades with channels of this type are reduced and, moreover, the distribution of losses over the height and pitch is more uniform. Graphs showing the relationship between the loss factor of the blading, the height and the angle of inlet are shown in Fig 3 for various kinds of blade. Curves showing the relationship between the loss factor, the ratio of the maximum to the inlet section and the

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Increasing the Efficiency of Short Turbine Runner Blades

height are shown in Fig 4; curves of the relationship between the loss factor, the pitch and the ratio of the maximum to the inlet section are shown in Fig 5. Optimum geometrical parameters for blades of group Ak are given in Table 3. It will be seen from Fig 5 and Table 3 that small variations in the ratio of the maximum to the inlet section do not appreciably affect the losses, the comparatively marked increase in losses at low relative pitch occurs because the channel is of less suitable shape. The influence of flow conditions on the efficiency of class Ak blading may be assessed from the graphs of Fig 6 and Fig 7. Fig 6 shows the influence of inlet angle; it will be seen that although the inlet losses do not vary much with inlet angle ranging from  $25^\circ$  to  $35^\circ$  the losses are less with blades Ak than with blades A. The influence of compressibility and Reynolds number on losses in the two types of blading is shown in Fig 7 and it is shown that compressibility does not have an appreciable

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# Increasing the Efficiency of Short Turbine Runner Blades

influence on the losses up to Mach 1. Tests made with blades B and Bk are shown in Fig 7b and it will be seen that at slightly supersonic speeds the presence of an expanding section beyond the inlet has a favourable effect on the losses. It is concluded that in blades where the flow is turned through large angles, the terminal losses may be appreciably reduced by using blades group Ak and Bk with expanding and constricting channels. The simplest way of making these blades is to cut back the concave surfaces of blades A and B which are widely used in turbines. The best amount of expansion of the inlet section depends mainly on the angle through which the flow is turned and the relative height of the blading. Blading of the type described should be used with relative heights less than 2 to 3 and when the flow is turned through angles greater than 120 to 125°. The use of these blades together with guide vanes type Am (having asymmetrical meridional profile) gives appreciable increase in stage

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E194/E484

Increasing the Efficiency of Short Turbine Runner Blades

efficiency of short blades. There are 7 figures,  
3 tables and 7 references, 6 of which are Soviet and  
1 German.

ASSOCIATION: Moskovskiy energeticheskiy institut  
(Moscow Power Institute)

Card 6/6

4

DEYCH, M.Ye., doktor tekhn.nauk, prof.; ZARYANKIN, A.Ye., kand.tekhn.nauk

Determination of optimum width of guide and runner blading in steam turbines. Izv. vys. ucheb. zav.; energ. 3 no. 9:61-67 8 '60.

(MIRA 13:9)

1. Moskovskiy ordena Lenina energeticheskiy institut. Predstavlena kafedroy teplotekhniki.

(Steam turbines--Blades)

S/096/60/000/C11/017/018

E073/E135

AUTHORS: Deych, M.Ye., Sherstyuk, A.N., Zaryankin, A.Ye.,  
Zatsepin, M.F., and Frolov, L.B.

TITLE: Investigation of Low Power Radial Turbines

PERIODICAL: Teploenergetika, 1960, No. 11, p 94

TEXT: This is an annotation of a recent research report by MEI. The technique of calculation of radial turbines is considered, giving experimental results on determining the influence of the nozzle system, the outflow angle of the flow  $\alpha_1$  and of the twist of the runner wheel, on the economics of the turbine. An electronic r.p.m. gauge is described. A method is presented of plotting profiles of nozzle systems of radial turbines, their geometrical dimensions and their experimental characteristics, and also data on investigating five runner wheels of various types. A maximum stage efficiency of  $\eta_{oi} = 0.32$  was obtained. Theoretical considerations are given on calculating the end losses in nozzle lattices with a flow from the centre and towards the centre, and also certain calculations on determining the optimum chord of turbine profiles calculated for subsonic and supersonic flow speeds. There are no figures, tables or references.  
Card 1/1

26.2170  
27648

S/024/61/000/004/006/025

E194/E155

AUTHORS: Zaryankin, A.Ye., and Zatsepin, M.F. (Moscow)

TITLE: The influence of the radial gap on the efficiency of a radial-axial turbine

PERIODICAL: Izvestiya Akademii nauk SSSR, Otdeleniye tekhnicheskikh nauk, Energetika i avtomatika, 1961, No.4, pp. 32-36

TEXT: The radial gap between the discharge edges of the nozzle gear and the inlet edges of the runner is often selected arbitrarily. On the one hand, as this gap is increased the velocity distribution before the runner becomes more uniform, which reduces the inlet losses and also reduces the losses in the ducts between the nozzle blades. However, increasing the gap increases frictional losses in the flow moving over the end walls of the annular ducts. In order to assess the order of magnitude of each of these kinds of loss, the flow between two plain walls in the annular gap is considered mathematically. Theory and static tests on radial turbine nozzles show that at low Mach numbers the flow in the annulus moves approximately in logarithmic spirals and the current lines are expressed in polar coordinates by the relation:  
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The influence of the radial gap on ... <sup>27648</sup> S/024/61/000/004/006/025  
E194/E155

$$r = r_0 \exp(-\varphi \operatorname{tg} \alpha_1) \quad (1)$$

where:  $r_0$  is the radius of the discharge edges of the nozzle;  
 $\alpha_1$  is the angle of discharge of flow from the nozzles;  $r$  is the  
instantaneous radius of the line of flow;  $\varphi$  is the polar angle.  
The change of speed along the flow line is determined by the  
following expression:

$$\frac{c}{c_0} = \frac{r_0}{r} = \exp(\varphi \operatorname{tg} \alpha_1) \quad (2)$$

where  $c_0$  is the speed at discharge from the nozzle.  
Knowing the flow lines and the speed, the following expression  
between the speed  $c$  and the instantaneous length of the segment  
of the logarithmic spiral contained between radii  $r_0$  and  $r$  is  
given by:

$$\frac{c}{c_0} = \frac{1}{1 - \frac{S}{r_0} \sin \alpha_1} \quad (5)$$

The following expression is then derived for the increased thickness  
of the layer of loss of impulse along a flow line in the gap:

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$$\delta^{**} = \frac{0.342}{\sqrt{Re_1 \sin \alpha_1}} \sqrt{1 - \frac{1}{(1 + \bar{\Delta}_3)^{3.75}}} \quad (8)$$

where  $\bar{\Delta}_3$  is the length of the radial gap. From these expressions the change in impulse loss with change in radial gap can be calculated. The curve of

$$\sqrt{Re_1 \sin \alpha_1} = f(\bar{\Delta}_3)$$

plotted in Fig.2 shows that as the gap length increases the thickness of impulse loss layer in the gap first increases markedly, but later the increase slows off, and when  $\bar{\Delta}_3$  is between 0.3 and 1,  $\delta^{**} \sqrt{Re_1 \sin \alpha_1}$  alters only by 0.05. This shows that the gap affects the frictional losses only in the range of  $\bar{\Delta}_3$  from 0 to 0.3. This characteristic is of general validity as it does not depend on the Reynolds number or the flow discharge angle  $\alpha_1$ . The method of calculating the change in thickness of the impulse loss layer in the annular gap in any specific case is then explained. In particular, a correction factor  $k_3$  is derived to Card 3/6

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allow for the work of pressure forces which is usually not allowed for in calculating losses from the final characteristic of the boundary layer. The following expression is then derived for the coefficient of energy loss in the gap:

$$\zeta_3 = \frac{3.6 \bar{\delta}_1^{**} (1 - \theta) k_3}{\bar{l}} \quad (12)$$

where:  $\theta$  is the degree of reaction of the turbine;  $\bar{l} = l/r_1$  is the relative height of the nozzle gear. To facilitate use of this formula, Fig. 2 shows the relationship

$$\delta^{**} k_3 \sim \frac{Re_1 \sin \alpha_1}{\Delta_3}$$

as a function of the gap length  $\bar{\Delta}_3 = \Delta_3/r_1$ . These curves permit ready calculation of additional frictional losses in the gap. Similar calculations for the turbulent boundary layer give the following expressions for the thickness of the impulse loss layer:

$$\bar{\delta}_m^{**} = \frac{0.00656}{Re_1^{1/7} \sin^{4/7} \alpha_1} \left[ 1 - \frac{1}{(1 + \bar{\Delta}_3)^{1.8}} \right]^{4/7} \quad (13)$$

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In using expression (12),  $\bar{\delta}''$  is determined by Eq.(13). Comparison of curves plotted by expression (12) with experimental data shows generally good agreement but expression (12) gives a greater drop of efficiency than experiment. The reasons for this are discussed. As the gap length is increased, the part played by the nozzle gear continually diminishes, since the main acceleration of the flow is transferred to the radial gap. With large gaps, nozzle guide vanes should be used only to give the flow the required direction in the annular gap. In this case formula (12) gives an accurate solution of the problem and it may be used to consider the question of use of bladeless nozzle equipment. Test results are quoted which show that the use of bladeless nozzle gear gives a gain only for small values of Reynolds number. However, with relatively short blades the use of profiled shrouding affords considerable advantages as compared with bladeless nozzle gear. Thus it is recommended to use bladeless nozzle gear at low speeds when  $Re > 0.10$ . In other cases it is better to have nozzle gear with blades and a minimum gap, using profiled shrouding. There are 5 figures and 3 Soviet references.

SUBMITTED: March 17, 1961  
Card 5/6

ZARYANKIN, A.Ye.; FEDOTOVSKIY, A.P., red.

[Heat exchangers of gas] Teploobmennye apparaty gazoturbinykh ustanovok. Moskva, Mosk. energet. in-t, 1961. 107 p.  
(MIRA 17:7)

ZARYAN, A.Ye., kand. tekhn. nauk; PROLOV, L.B., inzh.

Measurement of the number of revolutions with recording on an  
automatic potentiometer. Energomashinostroenie 7 no.11:42-  
44 N '61. (MIRA 14:11)

(Tachometer)  
(Potentiometer)  
(Turbomachines--Testing)

ZARYANKIN, A.Ya., kand.tekhn.nauk; SHERSTYUK, A.N., kand.tekhn.nauk;  
ZATSEPIN, M.F., inzh.

Experimental characteristics of Francis-type turbines.  
Teploenergetika 8 no.6:37-41 Je '61. (MIRA 14:10)

1. Moskovskiy energeticheskiy inatitut.  
(Turbines—Testing)

28572

S/143/61/000/008/003/005  
D203/D305

26.2/20

AUTHORS: Zaryankin, A.Ye., Candidate of Technical Sciences,  
Zatsepin, M.F., and Nikitin, V.N., Engineers

TITLE: An experimental investigation of the radial and  
radial-axle stages

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Energetika,  
no. 8, 1961, 60-66

TEXT: The experiments were carried out with an experimental tur-  
bine type MЭW(MEI) shown in Fig. 1. The air was supplied to the  
turbine from a blower ( 1 and 3 atmospheres) and a temperature of  
200°C, through the meter nozzle 14. The power developed by the  
turbine was consumed by the three-stage hydro-brake. The demand  
for the air was calculated from

$$G = A \sqrt{\Delta p_c \frac{p_c}{T_c}} \quad (1)$$

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S/143/61/000/008/003/005  
D203/D305

An experimental investigation ...

where  $\Delta p_c$  is the pressure drop on the nozzle,  $p_c$  - the pressure before the nozzle,  $T_c$  - the temperature. The efficiency and magnitude of the reaction was calculated from the known expressions

$$\eta_{01} = \frac{M n}{980 G T_0 \left[ 1 - \left( \frac{p_2}{p_0} \right)^{0,286} \right]} \quad (2)$$

and

$$\rho = \frac{\left( \frac{p_1}{p_0} \right)^{0,286} - \left( \frac{p_2}{p_0} \right)^{0,286}}{1 - \left( \frac{p_2}{p_0} \right)^{0,286}} \quad (3)$$

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An experimental investigation ...

<sup>28572</sup>  
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D203/D305

Four stages were investigated in the experimental turbine, differing only by the rotors working with the same nozzle apparatus. The profile MEI, Ts-2r was taken as a basis, having an angle  $\alpha_{1\text{ef}} = 15^\circ$  with the relative pitch  $\frac{t}{b} = 0.64$ . The rotors are shown. The first three rotors had the same peripheries and the radial blades at the inlet had the same outlet diameter. The fourth wheel was of radial type only and the curved blades with the outlet edges were of diameter  $d_2 = 78$  mm. The number of blades were 16 on the first wheel, 12 on the second and third wheel and 18 on the fourth wheel. The edges of the first wheel had a variable angle  $\beta_2$  equal to  $56^\circ$  at the root and  $1^\circ$  at the top. The second wheel had the curved outlet edges ( $\beta_{21} = 90^\circ$ ). The internal efficiency  $\eta_1$  is also shown graphically. The best result was obtained with the wheel No. 1 which showed for  $\frac{u_1}{c_0} = 0.55$  to  $0.65$  an efficiency of

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An experimental investigation ...

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80-83%, and with the improved helix even 84%. The reaction for wheel No. 1 varied considerably with the variation of  $\frac{u}{C_0}$  and was found to depend on the method of sealing the rotor. A graph shows that the lack of sealing on the rear side of the working wheel diminishes the reaction by 8%, and with an increase of  $\frac{u}{C_0}$ , there is a considerable increase of reaction. The investigation of the radial stage No. 4 showed that its efficiency was somewhat lower than that of the radial axle stage No. 1, although they had the same ratio  $\frac{d_2}{d_1}$ , and zero curvature at the outlet ( $C_{zn} = 0$ ). The losses at the outlet velocity in a radial stage were 1.6 times greater than those in a radial axle stage. The dependence of the reaction magnitude on the ratio  $\frac{u_1}{C_0}$  for wheel No. 4 was found to be of different quality. For a known value of reaction, the output and the coefficient of velocity of a radial turbine, the mean

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An experimental investigation ...

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angle  $\alpha_1$  of the outlet of the flow are determined from the following expressions,

$$C_{m1} = \frac{G}{2\pi r_1 l \varphi_1} \quad (4)$$

$$C_1 = 91,5 \varphi \sqrt{(1 - \rho) H_0} \quad (5)$$

where  $l$  - the height of the nozzle,  $r_1$  the radius of the outlet edges of the nozzle.

$$\sin \alpha_1 = \frac{C_{m1}}{C_1} = \frac{G}{575 r_1 l \varphi_1 \sqrt{(1 - \rho) H_0}} \quad (6)$$

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D203/D305

An experimental investigation ....

is then derived. Denoting  $\gamma_1$  in terms of the temperature and pressure

$$\sin \alpha_1 = 0,5 \frac{GT_0 [1 - 3,5\varphi^2(1-\rho)H_0]}{r_1 l_1 \rho p_1 \sqrt{(1-\rho)H_0}} \quad (7)$$

is obtained. It follows from Eq. (7) that the outlet angle depends on the losses in the nozzle apparatus and increases with the increase of  $\varphi$ . However, the mean angle on the axle type turbines differs from the local angles of the flow outlet because of the greater irregularity of the flow. In the radial turbines, this difference is insignificant and the angle  $\alpha$  could be taken as an aerodynamic angle of the flow outlet from the nozzle lattice. The gap flow in the direction of the rotor moves as a logarithmic spiral with an almost constant angle  $\alpha_1$ . There is a further acceleration of the flow, whose magnitude depends on the radius of the

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D203/D305

An experimental investigation ...

nozzle installation and on the relative size of the radial gap. The size of this gap depends on the profile type and on the rela-

tive height of the nozzle apparatus  $l_1 = \frac{l_1}{d_1}$ . The increase of the

flow width of the gap is accompanied by an increase in losses, caused by internal friction and the friction against the face wall of the ring gap. With an increase of the gap, the role of temperature drop in the nozzle apparatus decreases, whereas the temperature drop in the ring gap increases. It follows that with good aerodynamic profiles with small relative heights  $l_1 < 0.1$ , a sharp decrease of the optimal gap takes place. The experiments resulted in the following conclusions: 1) The investigated curvatures of the outlet blade-edges proved their useful justification; 2) A comparison of the radial axle and radial stages showed that with a good profile, their efficiency could be of the same order; 3) The theoretical and experimental investigation of the influence of the radial gap showed that its increase under the specified conditions could be fully justified. There are 6 figures and

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28572

An experimental investigation ...

S/143/61/000/008/003/005  
D203/D305

2 Soviet-bloc references-

ASSOCIATION: Moskovskiy ordena Lenina energeticheskii institut  
(Moscow Order of Lenin Institute of Energetics)

SUBMITTED: June 23, 1960

Card 8/9

f

11.9200

39023  
S/184/62/000/004/001/006  
D040/D113

AUTHORS: Karyankin, A. Ye., Candidate of Technical Sciences, and  
Mitenkov, V.D., Engineer

TITLE: Results of an investigation on aerostatic bearings //

PERIODICAL: Khimicheskoye mashinostroyeniye, no. 4, 1962, 18-22

TEXT: Factors affecting the performance of air bearings were studied by the Moskovskiy energeticheskiy institut (Moscow Power Engineering Institute) on a graduated bronze shaft in a steel bushing. A specially built experimental rig was used. It included an air feed system with a small air turbine, a group pressure gage simultaneously recording pressure in 48 spots in the air gap, an indexed dial indicator showing the vertical motions of the shaft, and an electronic rpm counter. A formula qualitatively expressing the factors affecting the bearing capacity was derived. Minimum possible gaps should be used in air bearings because this sharply

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39022

S/104/62/000/004/001/206  
D040/D113

Results of an investigation ...

increases the load capacity and reduces air consumption. Gaps narrower than 0.05 mm should not be used, and the specific load should be reduced if the eccentricity is too high and there is a danger of the shaft contacting the bushing; the use of an auxiliary air inlet system (Fig. 6) resulted in the load capacity being uniformly distributed along the shaft neck in the bushing; such a bushing can be used for shafts with a specific radial load greater than 0.2 Kg/cm<sup>2</sup> at 12000 rpm. In experiments with a thrust bearing, the specific load was varied from 0.3 to 1 Kg/cm<sup>2</sup> without impairing the performance, and it was found that the air should best be fed-in along the periphery of one half of the thrust plate diameter. Calculations and graphs, showing the dependence of the air pressure in the gap and its distribution on the initial air pressure and the point of air inlet and the dependence of the load capacity on the eccentricity and shaft rpm, are included. There are 7 figures.

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37640  
S/143/62/000/004/002/006  
D238/D307

76.0120

AUTHORS: Zaryankin, A.Ye., Candidate of Technical Sciences,  
and Zatsepin, M.F., Engineer

TITLE: The influence of losses in the working disc on the  
efficiency of a radial-axial turbine

PERIODICAL: Izvestiya vysshikh uchebnykh zavedeniy. Energetika,  
no. 4, 1962, 79 - 84

TITLE: Due to the relative absence of direct experimental data re-  
garding the influence of the working disc on the efficiency of a ra-  
dial-axial turbine and bearing in mind the extent to which the aero-  
dynamic properties of the working disc largely govern the efficiency  
of the turbine stage, a study is made of some theoretical concepts  
and experimental data affording an assessment of the influence of  
the loss factor and involution of the discharge edges of the working  
disc on the efficiency of this type of turbine. Efficiency is stud-  
ied on the basis of

$$\eta = 2(c_{1u}^2 - c_{2u}^2)/c_0^2$$

(1)

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The influence of losses in the ...

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D238/D307

where  $c_{1u}$  and  $c_{2u}$  is the peripheral projection of the absolute velocities;  $u$  is the peripheral velocity at inlet and discharge from the disc;  $c_0$  is an arbitrary velocity corresponding to the heat transfer available. Since this equation is generally complex, the study is made on a stage with relative velocities connected by the relation  $\omega_{2t} = \omega_1$ . The effect of disc losses on turbine stage efficiency is largely a function of the degree of radial orientation of the disc and the blade angle. The effect diminishes markedly with a small entry-to-discharge diameter ratio  $\nu$  and increased blade egress angle. In radial-axial- and radial stages with a geometric parameter  $\nu < 0.4$  the straight radial blade with egress angle  $90^\circ$  is the most effective and the profile is significant only for  $\nu > 0.4$ . Radial stage efficiency is best served by designing for minimum reactivity taking  $\rho = (1.1 \text{ to } 1.2) x_0(1 - \nu^2)$ , where  $x_0$  is the ratio of peripheral speed at the tip of a disc to the arbitrary velocity  $c_0$ .

There are 5 figures.

ASSOCIATION: Moskovskiy ordena Lenina energeticheskiy institut (Moscow 'Order of Lenin' Institute of Power Engineering)

SUBMITTED: May 4, 1961

Card 2/2

ZARYANKIN, A.Ye.

Calculating losses in continuously-operating diffusers. Izv.vys.-  
ucheb.zav.; av.tekh. 5 no.3:157-165 '62. (MIRA 15:9)  
(Diffusers)

26.2120

37554  
S/096/62/000/005/001/009  
E194/E454

AUTHORS: Zaryankin, A.Ye., Candidate of Technical Sciences,  
Sherstyuk, A.N., Candidate of Technical Sciences,  
Zatsepin, M.F., Engineer

TITLE: Some ways of increasing the efficiency of mixed flow  
turbines

PERIODICAL: Teploenergetika, no.5, 1962, 32-35

TEXT: At low pressure ratios (1.7 to 1.8) the efficiency of  
mixed flow turbines is around 80%, which it is important to  
increase because small gas turbines of this type are widely used.  
When the ratio of the blade width to diameter is below 0.05  
appreciable losses occur at discharge from the nozzles and runner  
and due to disc friction. Nozzle efficiency can be increased by  
meridional profiling, that is machining the blade with a twist in it,  
which reduces the speed and final pressure drops in the region of  
maximum curvature of gas flow. However, in some cases  
meridional profiling, whilst reducing the losses at subsonic speeds  
may increase them at supersonic speeds and whilst potentially very  
advantageous, the subject requires much further experimental study.  
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S/C96/62/000/005/001/009  
E194/E454

Some ways of increasing ...

Under certain conditions the use of profiled shrouding in an experimental turbine increased the efficiency by 4%. When the blades are very wide the spatial distribution of flow becomes important and under unfavourable conditions, although the flow is generally convergent, there may be divergent regions in the runner and the discharge velocity distribution may be very irregular, particularly when discharge velocity losses are high. Meridional guide vanes are usually designed to ensure the requisite change in cross-sectional area, but it is also important that they be smooth and with gradual changes of curvature. The runner blades too should have very gradual changes of curvature and should not have straight sections which can give rise to zones of divergent flow. Runner friction losses may be reduced by increasing the pressure drop in the stage. The value of the angle  $\alpha_1$  at which the flow breaks away depends mainly on the number of blades and relatively little on the twist of the discharge edge or the shape of the meridional guide. Discharge velocity losses may be high in a radial-axial stage even under design conditions and, therefore, the velocity of discharge should

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Some ways of increasing ...

S/096/62/000/005/001/009  
E194/E454

be converted in the subsequent diffuser section. If the turbine discharges to atmosphere a diffuser can reduce the pressure behind the runner so increasing the actual stage heat drop and increasing stage efficiency. Axially symmetrical diffusers directly beyond the runner are best but the discharge flow is often irregular and then diffusers which operate well under uniform flow conditions are not always best. For instance, in practical tests a curved diffuser was found better than a conical one although static tests showed them to have equal performance. There are 7 figures. ✓

ASSOCIATION: Moskovskiy energeticheskiy institut  
(Moscow Power Engineering Institute)

Card 3/3

ZARYANKIN, A.Ye., kand.tekhn.nauk

Methods of overall tests of diffusers and exhaust pipes. Teplo-energetika 9 no.3:89-91 Mr '62. (MIRA 15:2)

1. Moskovskiy energeticheskiy institut.  
(Gas turbines--Testing)

AM/016860

BOOK EXPLOITATION

S/

Zaryankin, A. Ye.; Sherstyuk, A. N.

Low-power radial-axial turbines (Radial'no-osevnyye turbiny\* maloy moshchnosti)  
Moscow, Mashgiz, 1963. 248 p. illus., biblio. Errata slip inserted. 3000  
copies printed. Reviewer: Professor G. S. Zhiritskiy; Managing editor:  
N. M. Zyugin; Publishing house editor: Engineer N. M. Paleyev; Technical  
editor: A. F. Uvarova; Proofreader: Ye. K. Shikunova; Cover artist: Ye. V.  
Beketova.

TOPIC TAGS: radial turbines, radial-axial turbines, low-power turbines, turbine  
stage, centripetal turbines, centrifugal turbines, turbine design, aerodynamic  
theory of turbines

PURPOSE AND COVERAGE: This book is intended for engineers and turbine specialists  
concerned with the design of radial-flow turbines. It also may be useful to  
students at power and machine-design vuzes in their study of turbine machinery.  
The fundamentals of the theory and design of radial- and radial-axial-flow  
turbines are presented. Special attention is paid to single-stage low-power  
radial-axial-flow turbines, which have found wide application in recent years.

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AM4016860

The book is based on the theoretical research of the authors and of other Russian and foreign specialists. It contains experimental material, basically that of the authors, on the testing of nozzle apparatuses and turbine stages and the influence of their geometry on the efficiency of stages. This book represents one of the first attempts to systematize the theory of radial-flow turbines, and contains only aerodynamic design problems associated with radial-flow turbines. Engineer M. F. Zatsepin helped prepare paragraph 43, Chapter VII, and, together with Engineer Yu. N. Dineyev, assisted with the experimental work. Engineer L. B. Frolov was responsible for the development and application of the measurement apparatus.

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